

WHAT IS CLAIMED IS:

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1. An apparatus for use in completing a subterranean zone penetrated by a wellbore, comprising:
- 5 a housing member having a longitudinal bore and an inner diameter;
- a valve member disposed within the housing member and movable between an open position and a closed position;
- a sliding sleeve disposed within the housing member having a longitudinal bore, movable between an upper position and a lower position, and having a seating element on which the valve member can seat;
- 10 wherein when the sliding sleeve is in the lower position, the valve member is held in the open position and communication is established between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member; and
- 15 wherein when the sliding sleeve is in the upper position, the valve member is held in the closed position and communication between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member is restricted.
- 20 2. The apparatus of claim 1, wherein the seating element is circular and is disposed within the longitudinal bore of the housing member and comprises an elastomeric sealing element.
- 25 3. The apparatus of claim 1, wherein the sliding sleeve further comprises a contact surface that contacts the valve member and restrains the valve member in the open position when the sliding sleeve is in the lower position.

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4. The apparatus of claim 3, wherein the valve member comprises a flapper type valve hinged on one side and a torsion spring member that urges the valve member towards a location between the open position and the closed position; wherein when the sliding sleeve is in the upper position, the torsion spring member urges the valve member to seat onto the seating element; and wherein when the sliding sleeve is between the upper position and the lower position and the contact surface is not in contact with the valve member, the torsion spring member urges the valve member to be located between the open position and the closed position and to protrude into the longitudinal bore of the second segment.

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5. The apparatus of claim 1, wherein the housing member comprises a first segment and a second segment, the first segment having a smaller inner diameter than the second segment and wherein the valve member is disposed within the second segment of the housing member.

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6. The apparatus of claim 5, wherein when the valve member is in the open position, the opening through the longitudinal bore of the second segment is at least as large as the inner diameter of the first segment.

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7. The apparatus of claim 1, further comprising:  
a spring element disposed within the housing, movable between a compressed position and an expanded position, that urges the sliding sleeve into the lower position;  
wherein when the sliding sleeve is in the upper position, the spring element is in the compressed position.

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8. The apparatus of claim 1, further comprising:  
a mandrel element, capable of being in an upper position and a lower position,  
disposed within the longitudinal bore of the housing and rigidly connected  
to the sliding sleeve.

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9. The apparatus of claim 8, further comprising:  
a shear sleeve member disposed within the longitudinal bore of the housing and  
capable of being in an upper position and a lower position, the shear  
sleeve member further comprising at least one locking element and at least  
one shear element;

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wherein when the shear sleeve member is in its upper position, the locking  
element prevents the shear sleeve member from moving longitudinally  
relative to the housing member.

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10. The apparatus of claim 9, further comprising:  
a latching element connected to the sliding sleeve and to the mandrel element,  
disposed within the longitudinal bore of the housing and capable of being  
in a latched or unlatched configuration and in an upper position and a  
lower position;

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wherein the latching element is connected to the shear sleeve member with at  
least one shear element.

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11. The apparatus of claim 10, wherein when the shear sleeve member is in its upper  
position and the latching element is in its upper position and connected to the  
shear sleeve member, a downward force can be exerted on the mandrel element  
that will move the mandrel element downward, causing the mandrel element to  
contact the latching element and forcing the shear element to break and  
disconnect the latching element from the shear sleeve member.

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12. The apparatus of claim 11, wherein when the latching element is disconnected from the shear sleeve member and is in its lower position, the latching element is in its latched configuration and unable to move longitudinally relative to the housing member, the sliding sleeve will be in its lower position and unable to move longitudinally relative to the housing member, and the valve member will be in its open position.

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13. The apparatus of claim 1, wherein the valve member comprises a disk having a concave surface on one side and a convex surface on the other side.

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14. The apparatus of claim 1, wherein the valve member is connected to a collar element, the housing member further comprises a collar groove, the collar element is housed within the collar groove and the collar element comprises a collar notch to prevent the collar element from rotating within the collar groove.

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15. The apparatus of claim 1, wherein the housing member further comprises a retaining ring that engages with the sliding sleeve when the sliding sleeve is in the lower position and restricts movement of the sliding sleeve when engaged.

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16. The apparatus of claim 7, further comprising:  
a spring sleeve disposed within the housing, movable between an upper position and a lower position, urged toward the lower position by the spring element;  
wherein the spring sleeve is held in the upper position by at least one shear element that connects the spring sleeve to the housing member.

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17 The apparatus of claim 16, wherein the sliding sleeve further comprises a linking element and wherein when the sliding sleeve is in the upper position the linking element is attached to the spring sleeve.

5 18. The apparatus of claim 17, wherein when the sliding sleeve is in the upper position, the spring sleeve is in the upper position, and the linking element is attached to the spring sleeve, a downward force can be exerted on the sliding sleeve that will move the sliding sleeve downward, causing downward force on the spring sleeve and forcing the shear element to break and disconnect the spring sleeve from the housing member.

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19. The apparatus of claim 18, wherein when the spring sleeve is disconnected from the housing member the spring element urges the sliding sleeve towards its lower position.

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20. The apparatus of claim 1, wherein:  
the sliding sleeve further comprises a key slot, the key slot comprising an upper key stop and a lower key stop;  
wherein the housing member further comprises a key element that is located within the key slot and restricts the sliding sleeve from rotating;  
wherein when the sliding sleeve is in its upper position, the key element will contact the lower key stop to restrict further upward movement of the sliding sleeve, and the valve element will be in its closed position; and  
wherein when the sliding sleeve is in its lower position, the key element will contact the upper key stop to restrict further downward movement of the sliding sleeve, and the valve element will be in its open position.

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21. The apparatus of claim 1, wherein the valve member has a projection, the projection capable of restricting the rotational movement of the valve member to movement between the open position and the closed position.
- 5 22. The apparatus of claim 1, wherein the valve member is disposed within and connected to a valve housing, thereby creating a valve subassembly, the valve subassembly disposed within the housing.
- 10 23. The apparatus of claim 22, wherein the valve subassembly is capable of rotational movement within the housing.
24. The apparatus of claim 22, wherein the valve subassembly is capable of limited longitudinal movement within the housing.
- 15 25. The apparatus of claim 22, wherein the sliding sleeve is capable of rotational movement within the housing.
26. The apparatus of claim 22, wherein the valve subassembly and the sliding sleeve are rotationally linked.
- 20 27. The apparatus of claim 26, wherein the valve subassembly comprises a guide, the sliding sleeve comprises a groove, and the guide is disposed within the groove creating a rotational linkage between the sliding sleeve and the valve subassembly.
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28. The apparatus of claim 24, wherein when the valve member is in its closed position, the valve subassembly is capable of longitudinal movement within the housing.

5 29. The apparatus of claim 28, wherein the valve subassembly is capable of moving the valve member away from the seating element, thereby enabling fluid communication through the apparatus.

10 30. The apparatus of claim 29, wherein the valve subassembly is capable of moving the valve member away from the seating element upon a force exerted from below the valve member.

15 31. An apparatus for use in completing a subterranean zone penetrated by a wellbore comprising:

a housing member having a longitudinal bore, an inner diameter, a first segment and a second segment, the first segment having a smaller inner diameter than the second segment;

20 a valve member disposed within the second segment of the housing member and movable between an open position and a closed position, hinged on one side and having a torsion spring member that urges the valve member towards a location between the open position and the closed position;

25 a sliding sleeve disposed within the housing member having a longitudinal bore and movable between an upper position and a lower position, having a seating element on which the valve member can seat and having a contact surface that contacts the valve member and restrains the valve member in the open position when the sliding sleeve is in the lower position;

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a spring element disposed within the longitudinal bore of the housing, movable between a compressed position and an expanded position, that urges the sliding sleeve into its lower position;

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a mandrel element disposed within the longitudinal bore of the housing, capable of being in an upper position and a lower position and connected to the sliding sleeve;

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a shear sleeve member disposed within the longitudinal bore of the housing and capable of being in an upper position and a lower position, the shear sleeve member comprising at least one locking element and at least one shear element;

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a latching element disposed within the longitudinal bore of the housing, connected to the sliding sleeve and to the mandrel element, capable of being in a latched configuration and an unlatched configuration, and capable of being in an upper position and a lower position, and connected to the shear sleeve member by at least one shear element;

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wherein when the sliding sleeve is in the lower position, the valve member is held in the open position and communication is established between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member;

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wherein when the sliding sleeve is in the upper position, the valve member is held in the closed position and communication between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member is restricted;

wherein when the shear sleeve member is in its upper position, the locking element prevents the shear sleeve member from moving longitudinally relative to the housing member;

wherein when the shear sleeve member is in its upper position and the latching element is in its upper position and connected to the shear sleeve element, a downward force can be exerted on the mandrel element, the mandrel



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element movement will contact the latching element and will force the shear element to break and disconnect the latching element from the shear sleeve member; and

wherein when the latching element is disconnected from the shear sleeve member and is in its lower position, the latching element is in its latched configuration and unable to move longitudinally relative to the housing member, the sliding sleeve is in its lower position and unable to move longitudinally relative to the housing member, and the valve member is in its open position.

32. An apparatus for use in completing a subterranean zone penetrated by a wellbore comprising:

a housing member having a longitudinal bore, an inner diameter and comprising a retaining ring and a key element;

a valve member disposed within the housing member and movable between an open position and a closed position, having a torsion spring member that urges the valve member towards a location between the open position and the closed position;

a sliding sleeve disposed within the housing member having a longitudinal bore and movable between an upper position and a lower position, comprising a seating element on which the valve member can seat, a key slot that is in sliding contact with the key element and restricts the sliding sleeve from rotating within the housing member, and a contact surface that contacts the valve member and restrains the valve member in the open position when the sliding sleeve is in the lower position;

a spring sleeve disposed within the longitudinal bore of the housing, capable of moving between an upper position and a lower position, the spring sleeve comprising at least one shear element;

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a spring element disposed within the longitudinal bore of the housing, movable between a compressed position and an expanded position, that urges the spring sleeve into its lower position;

a linking element disposed within the longitudinal bore of the housing, the linking element being connected to the sliding sleeve;

wherein when the sliding sleeve is in the lower position, the retaining ring prevents the shear sleeve member from moving longitudinally relative to the housing member, the valve member is held in the open position and communication is established between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member;

wherein when the sliding sleeve is in the upper position, the sliding sleeve is attached to the spring sleeve by the linking element, the valve member is held in the closed position and communication between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member is restricted;

wherein when the sliding sleeve is in its upper position and the linking element is in its upper position and connected to the spring sleeve, a downward force can be exerted on the sliding sleeve, the sliding sleeve movement will force the shear element to break and disconnect the spring sleeve from the housing member; and

wherein when the spring sleeve is disconnected from the housing member and is in its lower position, the linking element is attached to the sliding sleeve, the sliding sleeve is in its lower position unable to move longitudinally relative to the housing member, and the valve member is in its open position.

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33. An apparatus comprising:

a valve member comprising a disk having a concave surface on one side and a convex surface on the other side;

a collar element having a longitudinal bore therethrough; and

wherein the valve member is hingedly connected to the collar element and movable between an open position and a closed position.

34. The apparatus of claim 33, wherein the valve member comprises a torsion spring member that urges the valve member towards a location between the open position and closed position.

35. The apparatus of claim 33, further comprising an orienting notch on the outer diameter of the collar element.

36. A method for completing a subterranean zone penetrated by a wellbore, comprising:

providing an apparatus comprising a housing member having a longitudinal bore and an inner diameter, a valve member disposed within the housing member movable between an open position and a closed position, a sliding sleeve disposed within the housing member having a longitudinal bore and movable between an upper position and a lower position and having a seating element on which the valve member can seat, a mandrel element capable of being in an upper position and a lower position, a shear sleeve member capable of being in an upper position and a lower position and including at least one shear element, a latching element capable of being in a latched or unlatched configuration, wherein when the sliding sleeve is in the lower position, the valve member is held in the open position and communication is established between the longitudinal bore of the housing

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above the valve member and the longitudinal bore of the housing below the valve member, and wherein when the sliding sleeve is in the upper position, the valve member is held in the closed position and communication between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member is restricted;

positioning the apparatus within the wellbore with the sliding sleeve in the lower position holding the valve member open;

moving the sliding sleeve to its upper position, whereby the valve member is held in its closed position and communication through the longitudinal bore of the housing is restricted; and

imposing a force on at least one of the sliding sleeve or mandrel element such that the mandrel element transmits the force onto the shear element, breaks the shear element and allows the sliding sleeve to move to its lower position, thereby opening the valve member and allowing communication through the longitudinal bore of the housing.

37. The method of claim 36, further comprising:

attaching a gravel pack screen assembly, a packer and a work string to the apparatus prior to positioning the apparatus within the wellbore;

setting the packer and flowing a gravel laden slurry through the work string, packer and apparatus and placing the slurry between the wellbore and the gravel pack screen assembly while the valve member is held in its open position; and

disconnecting the work string from the apparatus and packer after the gravel laden slurry has been placed, shifting the sliding sleeve to its upper position and thereby holding the valve member in its closed position.

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A method for completing a subterranean zone penetrated by a wellbore, comprising:

providing an apparatus comprising a housing member having a longitudinal bore and an inner diameter, a valve member disposed within the housing member movable between an open position and a closed position, a sliding sleeve disposed within the housing member having a longitudinal bore and movable between an upper position and a lower position and having a seating element on which the valve member can seat, a spring element disposed within the housing, movable between a compressed position and an expanded position, a spring sleeve movable between an upper position and a lower position, and including at least one shear element, wherein when the sliding sleeve is in the lower position, the valve member is held in the open position and communication is established between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member, and wherein when the sliding sleeve is in the upper position, the valve member is held in the closed position and communication between the longitudinal bore of the housing above the valve member and the longitudinal bore of the housing below the valve member is restricted;

positioning the apparatus within the wellbore with the sliding sleeve in the lower position holding the valve member open;

moving the sliding sleeve to its upper position, whereby the valve member is held in its closed position and communication through the longitudinal bore of the housing is restricted; and

imposing a force on the sliding sleeve such that the sliding sleeve transmits the force onto the shear element, breaks the shear element and allows the sliding sleeve to move to its lower position, thereby opening the valve member and allowing communication through the longitudinal bore of the housing.

Sub 27 39. The method of claim 38, further comprising:

attaching a gravel pack screen assembly, a packer and a work string to the apparatus prior to positioning the apparatus within the wellbore;

5 setting the packer and flowing a gravel laden slurry through the work string, packer and apparatus and placing the slurry between the wellbore and the gravel pack screen assembly while the valve member is held in its open position; and

10 disconnecting the work string from the apparatus and packer after the gravel laden slurry has been placed, shifting the sliding sleeve to its upper position and thereby holding the valve member in its closed position.

40. A method for completing a subterranean zone penetrated by a wellbore, wherein a completion string is located within the wellbore, comprising:

15 providing an apparatus comprising a flapper type valve within the completion string, wherein the flapper type valve is movable between an open position and a closed position;

closing the flapper valve after completion operations have been preformed;

selectively locking the flapper valve in the closed position;

20 selectively releasing the flapper valve to the open position.

41. The method of claim 40, wherein the completion string is initially connected to a tubular string, further comprising the step of disconnecting the tubular string from the completion string and removing the tubular string from the wellbore after selectively locking the flapper valve in the closed position.

25 42. The method of claim 40, further comprising increasing the pressure in the wellbore to release the flapper valve.

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43. The method of claim 40, further comprising increasing the pressure in the completion string to release the flapper valve.

5 44. The method of claim 40, wherein an annulus exists between the completion string and the wellbore wall, further comprising increasing the pressure in the completion string-wellbore annulus to release the flapper valve.

10 45. The method of claim 40, further comprising shearing at least one shear element to release the flapper valve.

46. The method of claim 40, wherein the flapper valve seals from below.

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